Machine and Process for Producing a Multi-layered Fibrous Web

The invention relates to a machine for producing a multi-layered fibrous web, in particular a paper or cardboard web, in which the layers formed by each former are couched, i.e., connected. It further concerns a process according to the preamble of claim 26.

A machine and a process of this type are disclosed, for example, in the publications DE 197 04 443 A1, DE 198 03 591 A1, DE 197 33 316 A1, DE 196 51 493 A1, and DE 44 02 273 A1.

Different types of formers are known. For instance, in a Fourdrinier wire former, the dewatering occurs at the wire side. A concentration of fines at the upper side is achieved with power pulses. In a hybrid former, the main dewatering occurs at the wire side. In the upper wire zone, a dewatering occurs at the top which results in a reduction of the content of fines at the top. In a so-called roll blade gap former, the dewatering occurs first at the upper wire side and then at the lower wire side, which results in a higher content of fines at the lower wire side.

In the paper machines known from DE 197 04 443 A1 and DE 44 02 273 A1, combinations of two or more gap formers are used.

Embodiments of gap formers for the packaging field can be found, for instance, in publications DE 198 03 591 A1 (Duo Former Base) and DE 196 51 493 A1 (Duo Former Top). In the wire section described in DE 196 51 493 A1, the fibrous layer formed by the gap former and a first fibrous layer supplied by a continuous belt are couched at their upper wire sides that are low in fines. The jet direction of the headbox assigned to the gap former corresponds to the travel direction of the continuous belt supplying the first fibrous layer.

It is a disadvantage, however, that fibrous layers couched together at their sides

with a low content of fines have poor layer adhesion.

It is the object of the invention to create an improved process as well as an improved device of the above mentioned kind in which better layer adhesion is ensured in an economical and reliable fashion.

This object is obtained concerning the paper machine in that at least two layers that are to be couched, each having on one side a higher content of fines, are supplied to the respective couch zone in such a way that they come into contact with each other at their sides having the higher content of fines and in that at least one of these two layers is produced by a gap former.

This embodiment results in a number of crucial advantages in practice, such as in particular better layer adhesion, higher retention, a lower risk of so-called "sheet-sealing" effects, fewer deposits during drying, less dusting, as well as a positive influence on the paper characteristics concerning porosity, roughness, penetration characteristics, and printability.

In a preferred practical embodiment of the machine according to the invention, at least one of the two layers is produced by a gap former that contains two circulating continuous dewatering belts which merge forming a headbox nip and which, in the area of this headbox nip loaded by a headbox with fibrous suspension, are guided via a forming element such as, in particular, a forming roll or the like. At least one of the two dewatering belts can be provided, in particular, as a dewatering wire.

In an advantageous practical embodiment of the machine according to the invention, each of the two layers is formed by a gap former in each case. The sheet formation of the two layers each occurs with a higher content of fines at the forming element side. The web travel directions of the two gap formers are preferably opposite to each other. In this context, in particular, such an embodiment is conceivable in which the layer formed in the first of the two gap formers is guided with at least one of the two

dewatering belts around a deflection element, such as, in particular, a deflection roll or the like, and is subsequently supplied to the respective couch zone by means of a continuous belt in a direction generally opposite to the jet direction of the first headbox, in which couch zone the layers formed by the two gap formers are couched at their sides with the higher content of fines.

Here, for instance, the layer formed in the first gap former can be guided around the deflection element together with the outer dewatering belt, which does not come into contact with the forming element, and be supplied to the couch zone via this outer dewatering belt. Preferably, both dewatering belts are guided around the deflection element and the inner dewatering belt, following this deflection element, is separated from the outer dewatering belt which entrains the layer. Expediently, the outer dewatering belt of the first gap former following the deflection element is guided preferably in a generally horizontal direction, at least up to the area of the couch zone.

However, another embodiment is conceivable, for instance, in which a further layer is formed by a Fourdrinier wire former and the sheet formation of this layer occurs with a higher content of fines on the outer side facing away from the Fourdrinier wire, while the layer formed in the first gap former and guided over the deflection element is couched with the layer formed by the Fourdrinier wire former, and these two layers are supplied by means of the Fourdrinier wire to the couch zone in which the layers formed in the two gap formers are couched at their sides with higher content of fines. In this connection it is advantageous for the outer dewatering belt of the first gap former to be separated from the inner dewatering belt and the respective layer before the deflection element in the belt travel direction, and for the layer to be guided around the deflection element together only with the inner dewatering belt. The layer formed in the Fourdrinier wire former and the layer formed in the first gap former are preferably couched in the area of the deflection element and/or of a couch roll.

After a separation of the two respective dewatering belts of the second gap former, the layer formed by the second gap former can be supplied to the couch zone

together with the outer dewatering belt, in which couch zone the two layers formed in the gap formers are couched at their sides with a higher content of fines.

An alternative embodiment of the machine according to the invention is characterized in that a first of the two layers couched at their sides with a higher content of fines is formed by a Fourdrinier wire former and the sheet formation of this first layer occurs with a higher content of fines on the outer side facing away from the Fourdrinier wire and that the second layer is formed by a gap former and the sheet formation of this second layer occurs with a higher content of fines on the forming element side.

In this connection, the jet direction of the headbox assigned to the gap former advantageously corresponds generally to the travel direction of the first layer formed by the Fourdrinier wire former. The layer formed by the gap former, after a separation of the two dewatering belts of the gap former, is preferably supplied together with the outer dewatering belt to the couch zone in which merges with the Fourdrinier wire for couching the two layers. Preferably, the Fourdrinier wire can be guided generally in a horizontal direction at least in the area of the couch zone.

At least one further gap former is provided in a practical embodiment, the sheet formation of the respective further layer with higher content of fines occurring at the forming element side. The further layer is couched with the layer formed by the first gap former in a further couch zone. The jet direction of the headbox assigned to the further gap former preferably corresponds to the travel direction of the layer formed by the Fourdrinier wire former.

In a practical manner, after a separation of the two dewatering belts of the further gap former, the further layer formed by the further gap former is supplied together with the outer dewatering belt to the further couch zone, in which it is merged with the Fourdrinier wire for couching the two layers formed by gap formers. Preferably, the Fourdrinier wire is guided generally preferably in a horizontal direction, at least in the area of the two couch zones.

For the formation of an at least three-layer to four-layer fibrous web, at least one additional gap former can be provided, wherein the sheet formation of the additional layer with a higher content of fines occurs at the forming element side. The additional layer is couched with the layer formed by the preceding gap former in an additional couch zone, wherein at least one of the two layers is couched with the other layer at a side having a higher content of fines. The jet direction of the headbox assigned to the additional gap former preferably corresponds to the travel direction of the fibrous web to be formed.

A multi-layer headbox and/or a single-layer headbox and/or any combination of various headboxes can respectively be provided as a headbox.

Constant pressure dewatering elements can be provided for web dewatering, if necessary. They can be embodied, for instance, as is described in DE 197 33 316 A1.

The process according to the invention is accordingly characterized in that at least two layers to be couched, each with one side having a higher content of fines, are supplied to the respective couch zone in such a way that they come into contact with one another at their sides with a higher content of fines, and in that at least one of these two layers is produced by a gap former.

Advantageous embodiments of the process according to the invention are listed in the subordinate claims.

The invention shall be described in detail below using exemplary embodiments with reference to the drawings, which show:

Fig. 1 a schematic representation of an embodiment of a machine for producing a multi-layered fibrous web, in which both layers to be couched at their sides with a higher content of fines are each formed by a gap former,

Fig. 2 a schematic representation of a further embodiment of the machine, in which the two layers to be couched at their sides with a higher content of fines are formed

by a gap former in each case, a further, first layer being formed by a Fourdrinier wire former,

Fig. 3 a schematic representation of a further embodiment of the machine, in which the first of the two layers to be couched at their sides with a higher content of fines is formed by a Fourdrinier wire former and the second layer is formed by a gap former,

Fig. 4 a schematic representation of a further embodiment of the machine comparable to that in Fig. 3, a further gap former being provided for the formation of a further layer, here a third, layer, and

Fig. 5 a schematic representation of a further embodiment of the machine, based on that of Fig. 2 solely by way of example, an additional gap former being provided for the formation of an additional layer, here a fourth, layer.

Figs. 1 through 5 depict various embodiments of a machine for producing a multi-layered fibrous web, in particular a paper or cardboard web, in which the layers formed by each former are couched, i.e., connected.

The various embodiments have in common that in each case two layers to be couched, each having a higher content of fines on one side, are supplied to the respective couch zone in such a way that they come into contact with each other on their sides with a higher contact of fines, and that at least one of these two layers is produced by a gap former.

Fig. 1 depicts a machine for producing a two-layer fibrous web in which each of the two layers A, B is respectively formed by a gap former 10 and 12.

The gap formers 10, 12 each comprise two circulating continuous dewatering belts 14, 16 or 14', 16', which converge, forming a headbox nip 18 or 18' and which are guided in the area of this headbox nip over a forming element, here a forming roll 20 or 20'. The outer dewatering belt 16 is fed to the forming roll 20 over a breast roll 22. The headbox nip 18, 18' is respectively loaded with fibrous suspension by a headbox 24 or

24'. Inside the loop of the outer dewatering belt 16, 16', a forming shoe 26 or 26' is provided immediately following the forming roll 20, 20' in each case.

In the present case, layer A is formed by the gap former 10 and layer B is formed by the gap former 12. The sheet formation of the two layers A, B occurs in each case with a higher content of fines on the forming element side, i.e., here on the side of the forming roll 20, 20'.

As is discernible from Fig. 1, the belt travel directions L of the two gap formers 10, 12 and the jet directions of the headboxes 24, 24' assigned thereto are opposite to one another.

The layer A formed in the first gap former 10 is guided around a deflection element, here a deflection roll 28, together with both dewatering belts 14, 16 behind the forming roll 20 in the web travel direction L and subsequently fed to the couch zone 30 by means of the outer dewatering belt 16 in a direction generally opposite to the jet direction of the first headbox 24, in which couch zone the layers A, B formed by the two gap formers 10, 12 are couched at their sides with a higher content of fines. The corresponding distribution of fines is also depicted symbolically again on the right edge of Fig. 1.

Immediately following the deflection roll 28, the inner dewatering belt 14 is again separated from the outer dewatering belt 16 entraining the layer A.

Starting from the deflection roll 28, the outer dewatering belt 16 of the first gap former 10 is guided generally in a horizontal direction beyond the couch zone 30. Following this, this outer dewatering belt 16 is guided back again to the first gap former 10.

After a separation of the two dewatering belts 14', 16' of the second gap former 12, the layer B formed by the second gap former 12 is fed together with the outer dewatering belt 16' to the couch zone 30, in which the two layers A, B formed in the gap

formers 10, 12 are couched at their sides of higher content of fines. In the area of this couch zone 30, the outer wire belt 16', which entrains the layer B, is guided over a couch roll 32.

Fig. 2 depicts an embodiment of a machine for producing a three-layered fibrous web. Here, the first layer A is formed by a Fourdrinier wire former 34, the sheet formation of this layer A occurring with a higher content of fines on the outer side facing away from the Fourdrinier wire 36. The second layer B and the third layer C are each formed again by a gap former 10 or 12.

The layer B formed in the first gap former 10 and guided over the deflection roll 28 is couched with the first layer A formed by the Fourdrinier wire former 34 in the area of this deflection roll 28. Subsequently, the two layers A and B connected to one another are fed by means of the Fourdrinier wire 36 to the couch zone 30, in which the layers B, C formed by the two gap formers 10, 12 are couched at their sides with a higher content of fines. Again, the resulting distribution of fines is depicted symbolically in the right section of Fig. 2.

As can be seen in Fig. 2, in the present case the outer dewatering belt 16 of the first gap former 10 is separated from the inner dewatering belt 14 and the respective layer B in front of the deflection roll 28 in the web travel direction L. Accordingly, this layer B is guided here only together with the inner dewatering belt 14 around the deflection roll 28. Then, in the area of this deflection roll 28, the first layer A formed in the Fourdrinier wire former 34 and the second layer B formed in the first gap former 10 are couched.

After a separation of the two dewatering belts 14', 16' of the second gap former the layer C formed by the second gap former 12,, together with the outer dewatering belt 16' is supplied to the couch zone 30, in which the two layers B, C formed in the gap formers 10, 12 are then couched at their sides with a higher content of fines.

In contrast to the embodiment according to Fig. 1, here the layer formed by the

first gap former 10, i.e., here the layer B, is thus not supplied to the couch zone 30 by the outer belt of the first gap former 10, but rather by the Fourdrinier wire 36, on which couch zone a further layer, i.e., the first layer A, had previously already been formed. The design as well as the relative position of the two gap formers 10, 12 generally corresponds to those in the embodiment according to Fig. 1, parts corresponding to one another being assigned the same reference characters. The couching of the two layers B, C formed by the gap formers 10, 12 can occur in an area of a couch roll 32 wrapped by the outer dewatering belt 16' of the second gap former 12.

Fig. 3 depicts in a schematic representation a further embodiment of a machine for the production of a multi-layered, here again two-layered, fibrous web. In this case the first layer A of the two layers A, B to be couched at their sides of higher content of fines is formed by a Fourdrinier wire former 38. Here, the sheet formation of this first layer A occurs with a higher content of fines on the outer side facing away from the Fourdrinier wire 40. The second layer B is formed by a gap former 12, which in terms of design corresponds to the second gap former 12 of the embodiment according to Fig. 1. The sheet formation of the second layer B again occurs with a higher content of fines on the forming element side, i.e., on the side of the forming roll 20'.

The jet direction of the headbox 24' assigned to the gap former 12 corresponds in general to the travel direction LA of the first layer A formed by the Fourdrinier wire former 38.

After a separation of the two dewatering belts 14', 16' of the gap former, the layer A formed by the gap former 12 is supplied to the couch zone 30 together with the outer dewatering belt 16', in which couch zone it is merged with the Fourdrinier wire 40 for the couching of the two layers A, B at their sides of higher content of fines. The resulting distribution of fines is depicted symbolically in the right section of Fig. 3.

As is discernible in Fig. 3, the Fourdrinier wire 40 is guided generally in a horizontal direction starting from the assigned headbox 42 up to beyond the couch zone

30.

The embodiment depicted in Fig. 4 is different from that in Fig. 3 in that a further gap former 44 is provided for the production of a three-layered fibrous web. In the present case, this gap former corresponds in both design and orientation to the gap former 12 that forms the second layer B. The sheet formation of the third layer C again occurs with the higher content of fines on the forming element side.

The third layer C and the second layer B formed by the preceding gap former 12 are couched at their sides of higher content of fines in a further couch zone 46.

The jet direction of the headbox 48 assigned to the further gap former 44 corresponds to the travel direction LA of the first layer A formed by the Fourdrinier wire former 38. After a separation of the two dewatering belts 50, 52 of the further gap former 44, the third layer C formed by the further gap former 44 is supplied together with the outer dewatering belt 52 to the further couch zone 46, in which it is merged with the Fourdrinier wire 40 in order to couch the two layers B, C formed by the gap formers 12, 44.

The Fourdrinier wire 40 is guided beginning at the headbox 42 of the Fourdrinier wire former 38 beyond the first couch zone 30 as well as beyond the second couch zone 46 in a generally horizontal direction and it is subsequently guided back to the headbox 42 via deflection rolls.

Fig. 5 depicts schematically a further embodiment, only by way of example based on that in Fig. 2, in which an additional gap former 54 is provided for the formation of an additional, here fourth, layer D. In the present case, this additional gap former 54 is positioned in the machine travel direction behind the two gap formers 10, 12 provided according to the embodiment of Fig. 2.

The sheet formation of the additional layer D occurs with a higher content of fines

on the forming element side.

The design and orientation of the additional gap former 54 correspond in the present case to those of the preceding gap former 12 that forms the third layer C.

The fourth layer D is couched with the third layer C formed by the preceding gap former 12 in an additional couch zone 56, at least one of the two layers C, D, in the present case the fourth layer D, being couched with the other layer at a side with a higher content of fines.

The jet direction of the headbox 58 assigned to the additional gap former 54 corresponds to the travel direction of the fibrous web to be formed, i.e., in the present case, the travel direction LA of the first layer A formed by the Fourdrinier wire former 34.

Such an arrangement avoids the couching of two sides with low content of fines in the case of an additional layer D.

The resulting distribution of fines is depicted symbolically in the right section of Fig. 5. In principle, further gap formers are possible as well.

As is discernible from Fig. 5, the Fourdrinier wire 36 is guided at least essentially in a horizontal direction beginning at the headbox of the Fourdrinier wire former 34 over the first couch zone provided in the area of the deflection roll 28 of the gap former 10 as well as over the couch zone 30, in which the layers B and C are couched at their sides having a higher content of fines, and beyond the additional couch zone 56. The Fourdrinier wire 36 is subsequently guided back to the headbox of the Fourdrinier wire former 34. The present embodiment has the same design as that of Fig. 2 in other respects as well.

The expansion by at least one gap former, depicted in Fig. 5, for instance is also possible in the preceding embodiments.

In all cases the headboxes can be provided as multi-layered headboxes or as single-layered headboxes.

If necessary, constant pressure dewatering elements can be used for dewatering the web. They can be designed, for instance, as is described in DE 197 33 316 A1.

List of Reference Characters

10	Gap former
12	Gap former
14	Inner dewatering belt
14'	Inner dewatering belt
16	Outer dewatering belt
16'	Outer dewatering belt
18	Headbox nip
18'	Headbox nip
20	Forming roll
20'	Forming roll
22	Breast roll
22'	Breast roll
24	Headbox
24'	Headbox
26	Forming shoe
26'	Forming shoe
28	Deflection roll
30	Couch zone
32	Couch roll
34	Fourdrinier wire former
36	Fourdrinier wire
38	Fourdrinier wire former
40	Fourdrinier wire
42	Headbox
44	Further gap former
46	Couch zone
48	Headbox
50	Inner dewatering belt

52	Outer dewatering belt
54	Additional gap former
56	Additional couch zone
58	Headbox

A	Layer
B	Layer
C	Layer
D	Layer
L	Web travel direction
LA	Travel direction of the first layer

Claims

1. A machine for the production of a multi-layered fibrous web, in particular a paper web or a cardboard web, in which the layers (A, B; B, C) formed by a respective former (10, 12, 34, 38) are couched, characterized in that at least two layers (A, B; B, C) to be couched, each having on one side a higher content of fines, are supplied to the respective couch zone (30) in such a way that they come into contact with each other at their sides of higher content of fines, and in that at least one of these two layers (A, B; B, C) is produced by a gap former (10, 12).

2. The machine according to claim 1, characterized in that at least one of the two layers (A, B; B, C) is produced by a gap former (10, 12) which comprises two circulating continuous dewatering belts (14, 16) which converge, forming a headbox nip (18), and which are guided in the area of this headbox nip (18), which is supplied with fibrous suspension by a headbox (24), over a forming element (20), such as in particular a forming roll.

3. The machine according to claim 2, characterized in that each of the two layers (A, B; B, C) is respectively formed by a gap former (10, 12) and the sheet formation of the two layers (A, B; B, C) respectively occurs with higher content of fines on the forming element side.

4. The machine according to claim 3, characterized in that the belt travel directions (L) of the two gap formers (10, 12) are opposite to one another.

5. The machine according to claim 4, characterized in that the layer (A; B) formed in the first of the two gap formers (10, 12) is guided together with at least one of the two dewatering belts (14, 16) around a deflection element (28), preferably a deflection roll, and following this is fed by means of a continuous belt (16; 36), in a direction generally opposite to the jet direction of the first headbox (24), to

the respective couch zone 30, in which the layers (A, B; B, C) formed by the two gap formers (10, 12) are couched at their sides of higher content of fines.

6. The machine according to claim 5, characterized in that the layer (A) formed in the first gap former (10) is guided around the deflection element (28) together with the outer dewatering belt (16), which does not come into contact with the forming element (20), and is fed to the couch zone (30) by means of this outer dewatering belt (16).

7. The machine according to claim 6, characterized in that the two dewatering belts (14, 16) are guided around the deflection element (28), and the inner dewatering belt (14) is separated from the outer dewatering belt (16), which entrains the layer (A), following this deflection element.

8. The machine according to claim 6 or 7, characterized in that the outer dewatering belt (16) of the first gap former (10) following the deflection element (28) is guided in general preferably in a horizontal direction, at least up to the area of the couch zone (30).

9. The machine according to claim 5, characterized in that a further layer (A) is formed by a Fourdrinier wire former (34) and the sheet formation of this layer (A) occurs with higher content of fines on the outer side facing away from the Fourdrinier wire (36), that the layer (B) formed in the first gap former (10) and guided over the deflection element (28) is couched with the layer (A) formed by the Fourdrinier wire former (34) and in that these two layers (A, B) are supplied by means of the Fourdrinier wire (36) to the couch zone (30) in which the layers (B, C) formed by the two gap formers (10, 12) are couched at their sides of higher content of fines.

10. The machine according to claim 9, characterized in that the outer dewatering belt (16) of the first gap former (10) is separated in the belt travel direction (L) in front

of the deflection element (28) from the inner dewatering belt (14) and the respective layer (B), and the layer (B) is guided around the deflection element (28) only together with the inner dewatering belt (14).

11. The machine according to claim 9 or 10, characterized in that the layer (A) formed in the Fourdrinier wire former (34) and the layer (B) formed in the first gap former (10) are couched in the area of the deflection element (28) and/or of a couch roll.

12. The machine according to one of the preceding claims, characterized in that, after a separation of the two dewatering belts (14', 16') of the second gap former (12), the layer (B; C) formed by the second gap former (12) is supplied together with the outer dewatering belt (16') to the couch zone (30) in which the two layers (A, B; B, C) formed in the gap formers (10, 12) are couched at their sides of higher content of fines.

13. The machine according to claim 1 or 2, characterized in that a first layer (A) of the two layers (A, B) to be couched at their sides of higher content of fines is formed by a Fourdrinier wire former (38) and the sheet formation of this first layer (A) occurs with the higher content of fines on the outer side facing away from the Fourdrinier wire (40), and in that the second layer (B) is formed by a gap former (12) and the sheet formation of this second layer (B) occurs with a higher content of fines on the forming element side.

14. The machine according to claim 13, characterized in that the jet direction of the headbox (24') assigned to the gap former (12) corresponds in general to the travel direction (LA) of the first layer (A) formed by the Fourdrinier wire former.

15. The machine according to claim 13 or 14, characterized in that, after a separation of the two dewatering belts (14', 16') of the gap former (12), the layer (B) formed by the gap former (12) is supplied together with the outer dewatering belt (16') to

the couch zone (30) in which it is merged with the Fourdrinier wire (40) for couching the two layers (A, B).

16. The machine according to one of claims 13 through 15, characterized in that the Fourdrinier wire (40) is guided preferably generally in a horizontal direction at least in the area of the couch zone (30).

17. The machine according to one of the claims 13 through 16, characterized in that at least one further gap former (44) is provided and the sheet formation of the respective further layer (C) occurs with a higher content of fines on the forming element side and in that the further layer (C) is couched with the layer (B) formed by the first gap former (12) in a further couch zone (46).

18. The machine according to claim 17, characterized in that the jet direction of the headbox (48) assigned to the further gap former (44) corresponds to the travel direction (LA) of the layer formed by the Fourdrinier wire former (38).

19. The machine according to claim 17 or 18, characterized in that, after a separation of the two dewatering belts (50, 52) of the further gap former (44), the further layer (C) formed by the further gap former (44) is supplied together with the outer dewatering belt (52) to the further couch zone (46), in which it is merged with the Fourdrinier wire (40) for couching the two layers (B, C) formed by gap formers (12, 44).

20. The machine according to claim 19, characterized in that the Fourdrinier wire (40) is guided at least in the area of the two couch zones (30, 46) in general preferably in a horizontal direction.

21. The machine according to one of the preceding claims, characterized in that for the formation of an at least three-layered or four-layered fibrous web at least one additional gap former (54) is provided and the sheet formation of the additional

layer (D) occurs with higher content of fines on the forming element side, and that the additional layer (D) is couched with the layer (C) formed by the preceding gap former in an additional couch zone (56), wherein at least one of the two layers (C, D) is couched with the other layer at a side of higher content of fines.

22. The machine according to claim 21, characterized in that the jet direction of the headbox (58) assigned to the additional gap former (54) corresponds to the travel direction of the fibrous web to be formed.

23. The machine according to one of the preceding claims, characterized in that at least one multi-layered headbox and/or at least one single layered headbox and/or a combination of different headboxes is provided.

24. The machine according to one of the preceding claims, characterized in that at least one single layered headbox is provided.

25. The machine according to one of the preceding claims characterized in that constant pressure dewatering elements are provided for the web dewatering.

26. A process for the production of a multi-layered fibrous web, in particular a paper web or a cardboard web, in which the layers (A, B; B, C) formed by a respective former (10, 12, 34, 38) are couched, characterized in that at least two layers (A, B; B, C) to be couched, each having on one side a higher content of fines, are supplied to the couch zone (30) in such a way that they come into contact with each other on their sides with higher content of fines and that at least one of these two layers (A, B; B, C) is produced by a gap former (10, 12).

27. The process according to claim 26, characterized in that at least one of the two layers (A, B; B, C) is produced by a gap former (10, 12) which comprises two circulating continuous dewatering belts (14, 16) which converge forming a headbox nip (18) and which are guided in the area of this headbox nip (18),

loaded with a fibrous suspension by a headbox, over a forming element (20), such as in particular a forming roll.

28. The process according to claim 27, characterized in that each of the two layers (A, B; B, C) is respectively formed by a gap former (10, 12) and the sheet formation of the two layers (A, B; B, C) occurs in each case with the higher content of fines on the forming element side.

29. The process according to claim 28, characterized in that two gap formers (10, 12) of opposite web travel direction (L) are used.

30. The process according to claim 29, characterized in that the layer (A; B) formed in the first of the two gap formers (10, 12) is guided together with at least one of the two dewatering belts (14, 16) around a deflection element (28), preferably a deflection roll, and then by means of a continuous belt (16; 36) is supplied in a direction generally opposite to the jet direction of the first headbox (24) to the respective couch zone (30) in which the layers (A, B; B, C) formed by the two gap formers (10, 12) are couched at their sides of higher content of fines.

31. The process according to claim 30, characterized in that the layer (A) formed in the first gap former (10) is guided together with the outer dewatering belt (16), which does not come into contact with the forming element (28), around the deflection element (28) and is supplied to the couch zone (30) by means of this outer dewatering belt (16).

32. The process according to claim 31, characterized in that the two dewatering belts (14, 16) are guided around the deflection element (28) and the inner dewatering belt (14) is separated from the outer dewatering belt (16) entraining the layer (A) following this deflection element.

33. The process according to claim 30, characterized in that an additional layer (A) is

formed by a Fourdrinier wire former (34) and the sheet formation of this layer (A) occurs with higher content of fines on the outer side facing away from the Fourdrinier wire (36), that the layer (B), formed in the first gap former (10) and guided over the deflection element (28), is couched with the layer (A), formed by the Fourdrinier wire former (34), and that these two layers (A, B) are supplied by means of the Fourdrinier wire (36) to the couch zone (30) in which the layers (B, C) formed by the two gap formers (10, 12) are couched at their sides of higher content of fines.

34. The process according to claim 33, characterized in that the outer dewatering belt (16) of the first gap former (10) is separated from the inner dewatering belt (14) and the respective layer (B) in the web travel direction (L) in front of the deflection element (28), and the layer (B) is guided around the deflection element (28) only together with the inner dewatering belt (14).

35. The process according to claim 33 or 34, characterized in that the layer (A) formed in the Fourdrinier wire former (34) and the layer (B) formed in the first gap former (10) are couched in the area of the deflection element (28) and/or a couch roll.

36. The process according to one of the preceding claims, characterized in that after a separation of the two dewatering belts (14', 16') of the second gap former (10), the layer (B; C) formed by the second gap former (10) is supplied together with the outer dewatering belt (16') to the couch zone (30), in which the two layers (A, B; B, C) formed in the gap formers (10, 12) are couched at their sides of higher content of fines.

37. The process according to claim 26 or 27, characterized in that the first layer (A) of the two layers (A, B) to be couched at their sides of higher content of fines is formed by a Fourdrinier wire former (38) and the sheet formation of this first layer (A) occurs with a higher content of fines on the outer side facing away from

the Fourdrinier wire (40), and that the second layer (B) is formed by a gap former (12) and the sheet formation of this second layer (B) occurs with higher content of fines on the forming element side.

38. The process according to claim 37, characterized in that the jet direction of the headbox (24') assigned to the gap former (12) is selected in general corresponding to the travel direction (LA) of the first layer (A) formed by the Fourdrinier wire former.

39. The process according to claim 37 or 38, characterized in that after a separation of the two dewatering belts (14', 16') of the gap former (12), the layer (A) formed by the gap former (A) is supplied together with the outer dewatering belt (16') to the couch zone (30), in which it is merged with the Fourdrinier wire (40) for couching the two layers (A, B).

40. The process according to one of claims 37 through 39, characterized in that at least one further gap former (44) is used and the sheet formation of the respective further layer (C) occurs with a higher content of fines on the forming element side, and that the further layer (C) is couched in a further couch zone (46) with the layer (B) formed by the first gap former (12).

41. The process according to claim 40, characterized in that the jet direction of the headbox (48) assigned to the further gap former (44) is selected according to the travel direction (LA) of the layer formed by the Fourdrinier wire former (38).

42. The process according to claim 40 or 41, characterized in that after a separation of the two dewatering belts (50, 52) of the further gap former (44), the further layer (C) formed by the further gap former (44) is supplied together with the outer dewatering belt (52) to the further couch zone (46), in which it is merged with the Fourdrinier wire (40) for couching the two layers (B, C) formed by gap formers (12, 44).

43. The process according to one of the preceding claims, characterized in that at least one additional gap former (54) is used for the formation of an at least three-layered or four-layered fibrous web and the sheet formation of the additional layer (D) occurs with a higher content of fines on the forming element side, and that the additional layer (D) is couched in an additional couch zone (56) with the layer (C) formed by the preceding gap former, wherein at least one of the two layers (C, D) is couched with the other layer at a side of higher content of fines.

44. The process according to claim 43, characterized in that the jet direction of the headbox (58) assigned to the additional gap former (54) is selected according to the travel direction of the fibrous web to be formed.

45. The process according to one of the preceding claims, characterized in that at least one multi-layered headbox and/or at least one single-layered headbox and/or a combination of different headboxes is used.

Abstract

In a machine for the production of a multi-layered fibrous web, in particular a paper web or a cardboard web, in which the layers A, B formed by a respective former 10, 12 are couched, at least two sides A, B to be couched, having on one side in each case a higher content of fines, are supplied to the respective couch zone 30 in such a way, that they come into contact with one another at their sides of higher content of fines. Here, at least one of these two layers A, B is produced by a gap former 10, 12.

Fig. 1.

Figures

Lage Layer

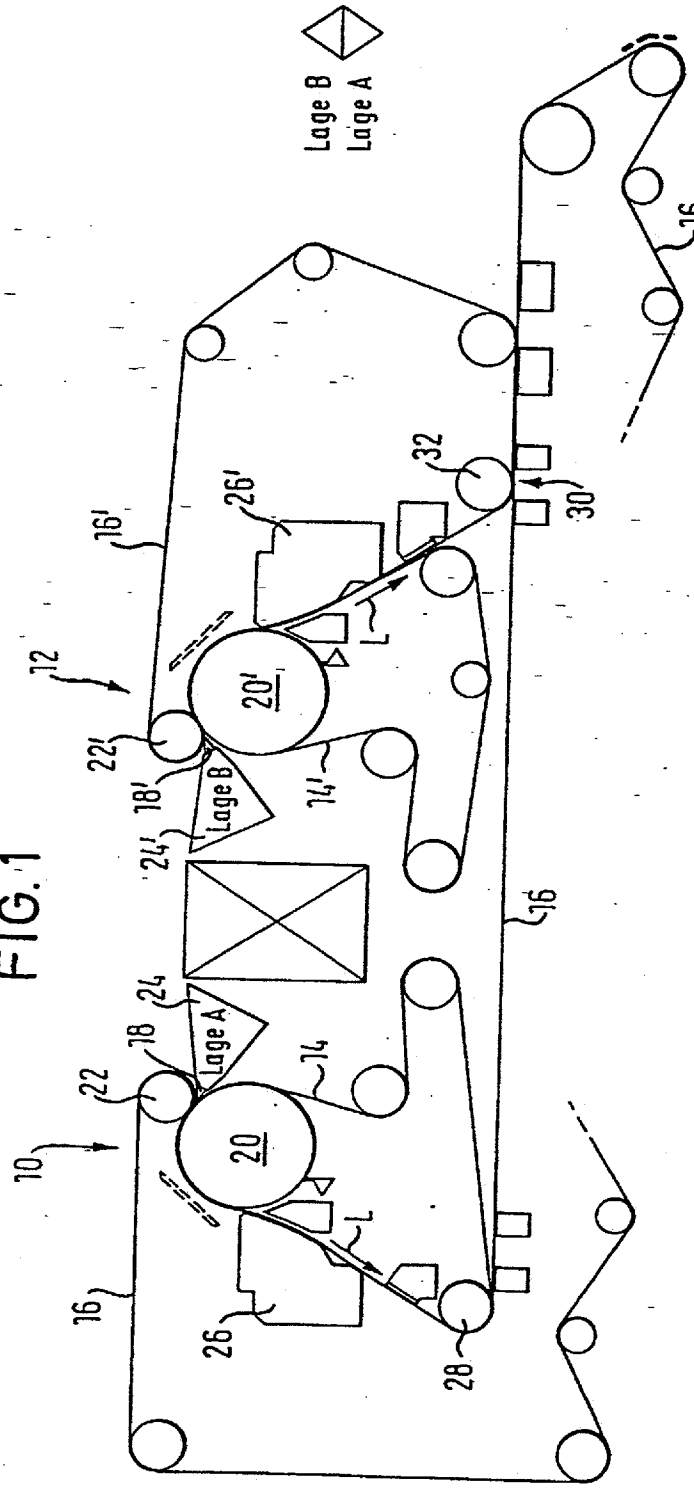

Lage B
Lage A
10
12
16
16'
18
18'
20
20'
22
22'
24
24'
26
26'
28
30
32
14
14'
L
Lage A
Lage B

FIG. 1

FIG. 2

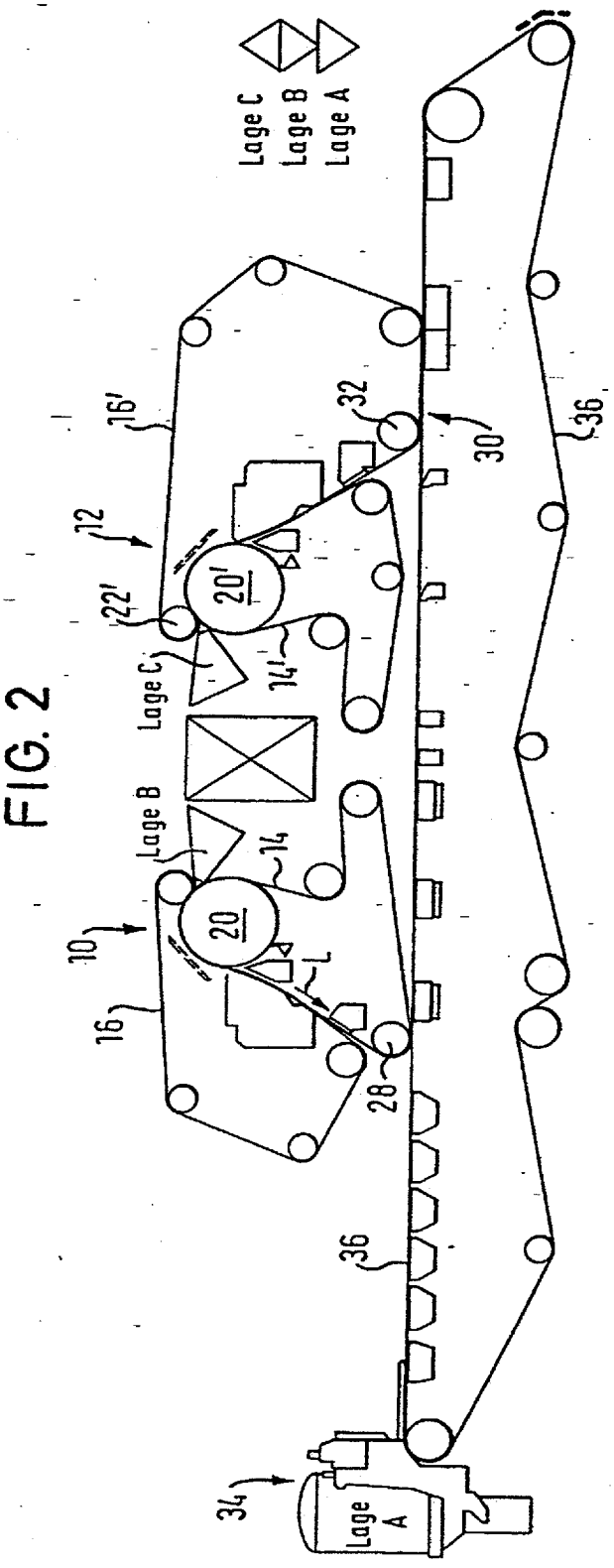

Lage C
Lage B
Lage A
16'
32
30
36
12
22'
20'
14'
Lage C
Lage B
14
10
20
16
28
36
34
Lage A

FIG. 3

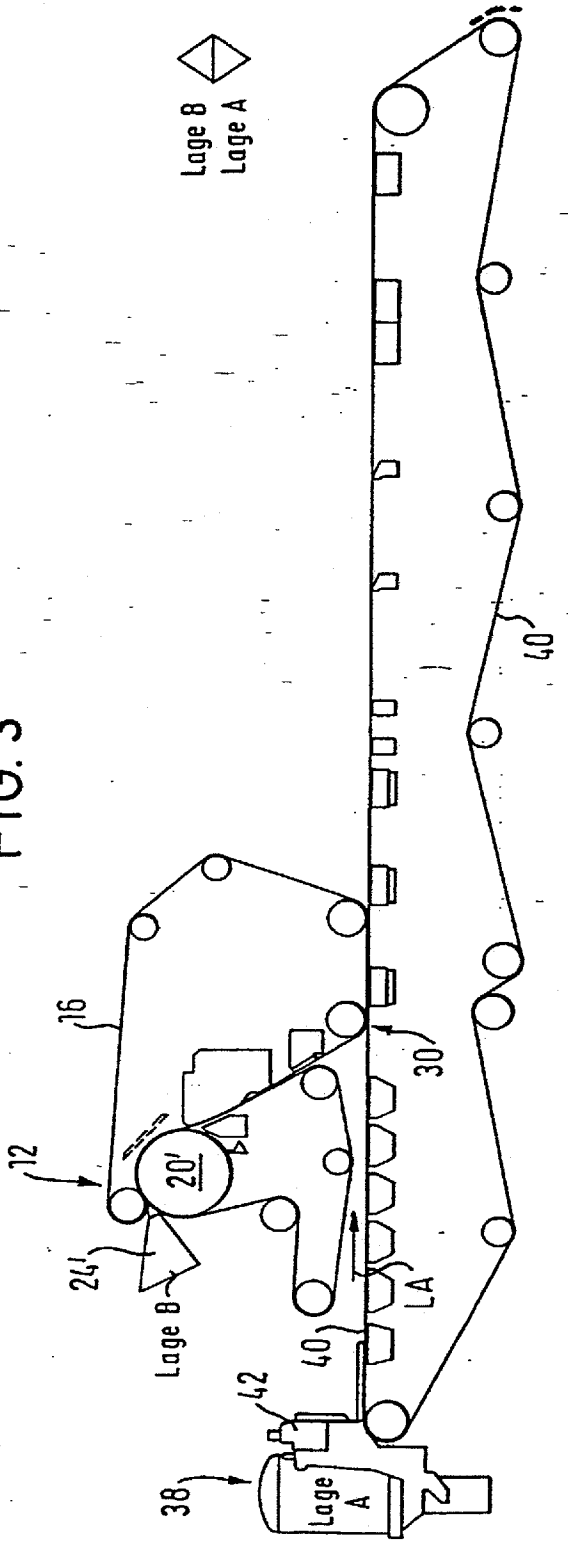


FIG. 4

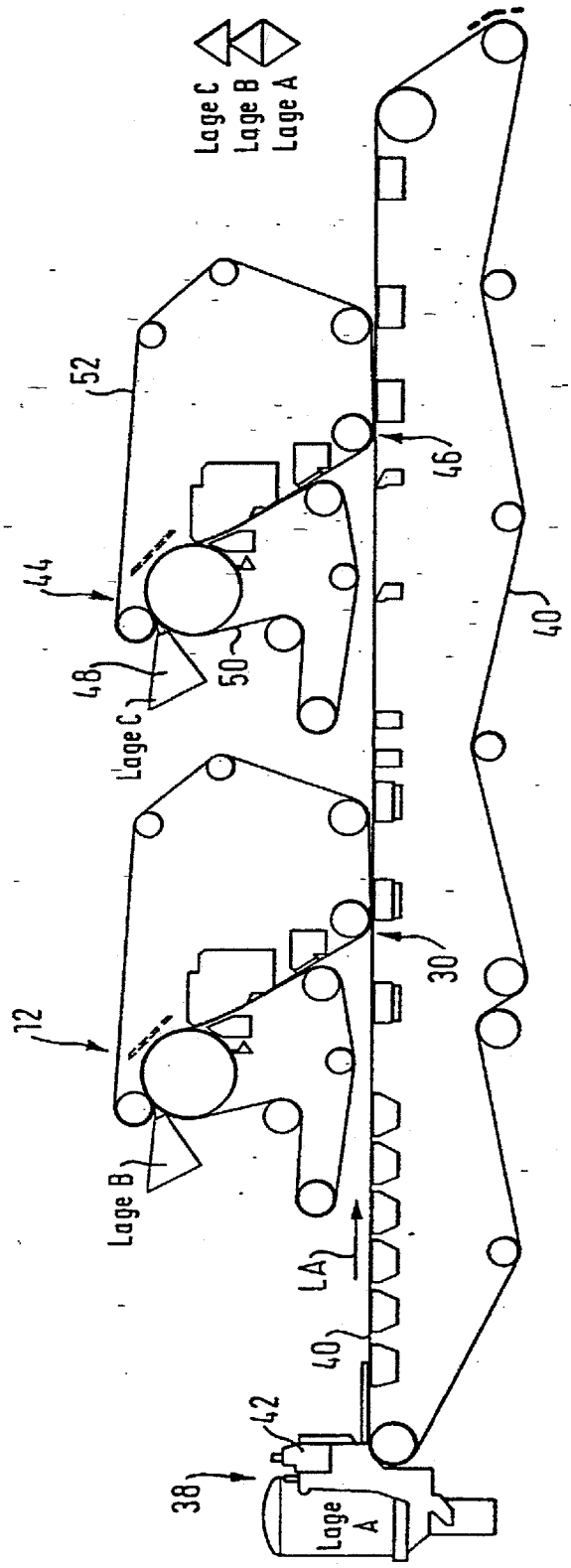
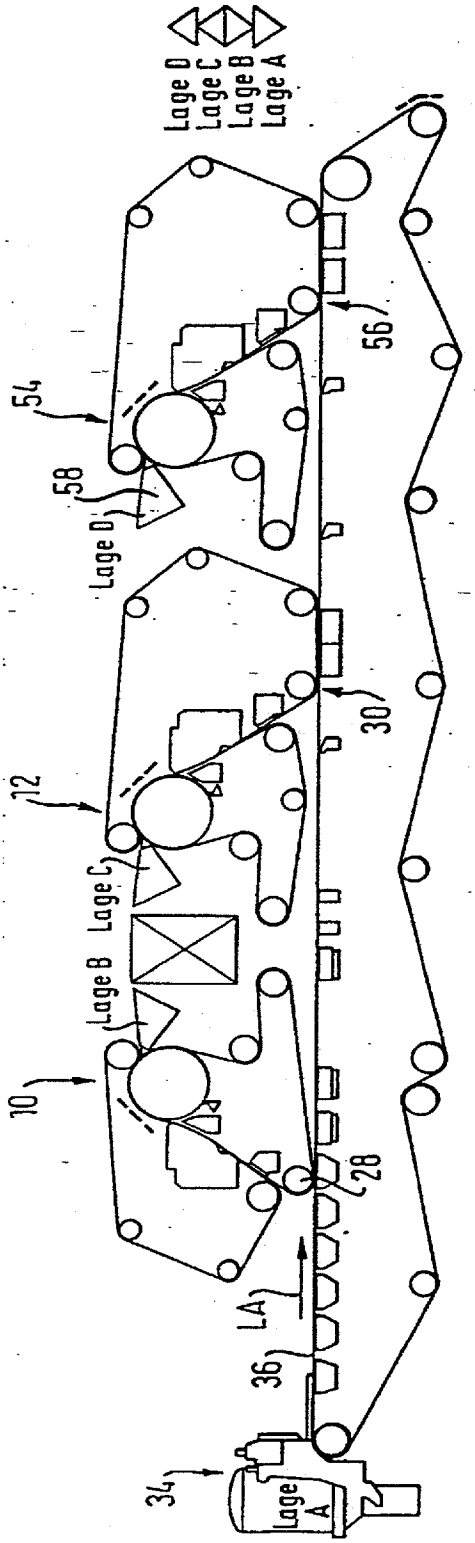

Lage C
Lage B
Lage A
52
46
44
40
48
50
Lage C
30
12
Lage B
LA
40
42
38
Lage A

FIG. 5


Lage D
Lage C
Lage B
Lage A
56
54
58
Lage D
30
12
Lage C
Lage B
10
28
LA
36
34
Lage A